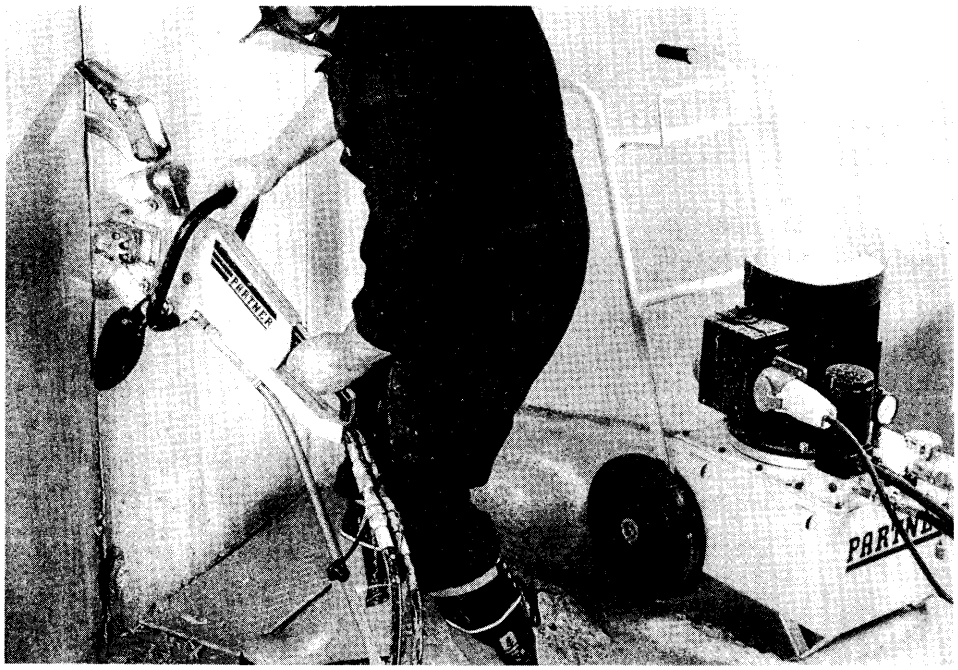
REMR TECHNICAL NOTE CS-MR-1.6

CONCRETE REMOVAL TECHNIQUE: DIAMOND BLADE SAW



Wall opening being cut using diamond blade saw

PURPOSE: To describe the use of a diamond blade saw for concrete removal.

APPLICATION: The diamond blade saw is most applicable for work that involves full-depth removal of concrete from thin sections and for work in which overbreakage and depth at removal boundaries are to be controlled. Full-depth removal has been successfully used for structural and highway demolition to remove large reinforced concrete sections from bridge decks and other thin sections. Equipment, such as a crane, supported and removed the section while a full-depth saw cut was made along the removal perimeter. Partial-depth saw cuts have been employed at Corps projects to reduce overbreakage from other removal techniques such as explosive blasting, impact devices, and presplitting methods and to provide a minimum replacement depth (usually 1 to 2 in.) along the removal boundary for spall repairs.

The two types of diamond saw-cutting techniques are wet and dry. The wet-cutting technique uses water to cool the blade and is used for most concrete flat and wall work. The dry-cutting technique uses no coolant other than the air passing over the blade. It is applicable for situations in which cutting periods and depths can be limited to avoid overheating and blade damage, and the use of water is not desired or convenient.

ADVANTAGES: A diamond blade saw is generally the most economical means of cutting concrete. Precision cuts can be made with minimal vibration and damage to the remaining concrete. No dust is produced when wet cutting is performed (water used to cool blade during cutting operation traps dust). Sizeable sections of concrete can be efficiently removed as units from slabs and other thin sections. Saw cuts made along removal limits can be used to significantly reduce the energy being transferred to the remaining concrete and, thereby, reduce overbreakage.

LIMITATIONS: The performance of a diamond blade is dependent on matching the hardness of the aggregate contained in the concrete with the correct diamond type and metal bond used in the blade segment. The recommended operating speeds for blades are dependent on the hardness of the aggregate contained in the concrete and the presence of reinforcement. The harder the aggregate, the shorter the blade life, the slower the cutting rate, and the higher the cost. The life of a diamond blade is significantly shortened and cutting rates slowed when the concrete being cut contains steel reinforcement.

Rotary-action diamond saws are limited to straight cuts. Overcutting occurs at the ends of saw cuts. Additional safety requirements and procedures are required by Engineer Manual 385-1-1 (Ref a) to protect operating personnel from the effects of overexposure to the high levels of noise produced by the cutting operation.

Wet cutting results in excess water in the work area, whereas dry cutting results in dust. The wet-cutting technique allows depths up to 21 in. to be cut (Ref b). The dry-cutting technique is used to make cuts of limited depth, usually 5 in. or less, so the blade can be periodically removed from the cut to prevent overheating. Dry cutting is not recommended for cuts that contain reinforcement.

PERSONNEL REQUIREMENTS: Trained personnel are required to operate the diamond blade saw. Personnel should be experienced enough to detect when a blade is overheating and to make adjustments quickly to limit damage to the blade.

EQUIPMENT: The wet-cutting technique uses blades that have the diamond-impregnated segments welded or silver brazed to the blade core, whereas the dry-cutting technique uses blades that have the segments laser welded. The composition of the diamond-impregnated segments of a blade is designed for cutting a specific range of aggregate hardness and should be selected according to the type of coarse aggregate contained in the concrete to be cut. The dry-cutting blades are best suited for use with low-horsepower saws (portable).

The saw used must have adequate horsepower for operating the blade at recommended speeds. Flat saws typically range from 8 to 65 hp, and wall saws from 10 to 35 hp (Ref c). The maximum speed required is based on the hardness of the coarse aggregate. A tachometer can be used to measure blade speed during the cutting operation. For deep cuts, a track system may be required to maintain alignment of the blade in the cut to avoid binding and damaging the blade.

Hydraulically powered saws and sound-dampened blades can be used to reduce noise levels. Reductions in noise up to 10 db are said to be possible with the sound-dampened blades (Ref d).

A ring saw can be used to make cuts deeper than the radius of the blade, thereby reducing the size of the saw needed and the cost for the job. One such saw uses a 14-in.-diam blade to make a 10-in.-deep cut (Ref e). The saw uses an off-center drive to propel a ring-shaped diamond blade. The blade is water cooled.

ENVIRONMENTAL CONSIDERATIONS: A determination should be made as to whether the area to be removed contains coatings or other materials that are considered to be hazardous or toxic. If present, proper handling and disposal under Resource Conservation and Recovery Act regulations may be required (see Technical Note EI-M-1.2, "Handling and Disposal of Construction Debris"). Precautions should be taken to minimize the travel of noise when sawing is performed in close proximity to groups of people. Concrete removed may be applicable for placement in open water to serve as a fish attractor reef. Several references are available (Ref f, g, h, and i) that contain suggestions for locating, sizing, and marking fish attractors.

COST: The cost of diamond saw cutting concrete varies widely depending on the job. Estimated cost for 1,000 lin ft of sawing is around $0.25/lin ft/1 in. of depth for flat work and $2.00 for walls. The cost of a 20-in.-diam blade ranges between $700 and $1,500.

REFERENCES:

a. Headquarters, US Army Corps of Engineers. 1981. "Safety and and Health Requirements Manual," Engineer Manual 385-1-1, Washington, DC.

b. _____. 1986. "Engineering and Design, Evaluation and Repair of Concrete Structures," Engineer Manual 11102-2-2002, Washington, DC.

c. Concrete Construction. 1985 (Sep). "Bits and Blades: What Makes Them Cut Faster and Last Longer," p 753.

d. _____. 1987a (Jul). "Tips on Cutting Concrete," p 626.

e. _____. 1987b (Apr). "Hand-Held Saw Makes 10-in. Cut," p 365.

f. Nelson, R. W., Horak, G. C., and Nelson, J. E. 1978. "Western Reservoir and Stream Habitat Improvements Handbook," US Department of the Interior, Fish and Wildlife Service, Fort Collins, CO.

g. Ryder, L. L. 1981. "Concrete Rubble and Miscellaneous Materials as Artificial Reef Material," Artificial Reefs, D. Y. Aska, ed., Report 41, University of Florida-Gainesville, Florida Sea Grant College, pp 89-91.

h. Schnick, R. A., and others. 1982. "Mitigation and Enhancement Techniques for the Upper Mississippi River System and Other Large River Systems," Resource Publication 149, US Department of the Interior, Fish and Wildlife Service, Washington, DC.

i. Seehorn, M. E. 1985. "Fish Habitat Improvement Handbook," Technical Publication R8-TP 7, US Department of Agriculture, Forest Service, Southern Region, Atlanta, GA.